

Problem 2 Astronomy takneek

Earth Radius = 149.60×10^6 km (R1)

Saturn's Radius = 1433.53×10^6 km (R2)

Jupiter's Radius = 778.479×10^6 km (R3)

Earth's Frequency = 6.2832 yr^{-1} (W1)

Saturn's Frequency = 0.2133 yr^{-1} (W2)

Jupiter's Frequency = 0.5297 yr^{-1} (W3)

Position of earth = $(R1\cos(W1t), R1\sin(W1t))$

Position of saturn = $(R2\cos(W2t), R2\sin(W2t))$

Position of jupiter = $(R3\cos(W3t), R3\sin(W3t))$

Relative position of saturn wrt earth A1 = $(R2\cos(W2t) - R1\cos(W1t), R2\sin(W2t) - R1\sin(W1t))$

Relative position of jupiter wrt earth A2 = $(R3\cos(W3t) - R1\cos(W1t), R3\sin(W3t) - R1\sin(W1t))$

For 2 vectors to be collinear, their ratio should be a real number i.e $A1 = kA2$

After solving these equations $t = 10.2925$ (Approx)

Thus time period for the great conjunction = $10.2925 \text{ years} \times 2 = 20 \text{ years}$ (Approx)

Therefore the great conjunction is going to occur in the year 2040.